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(71) Applicant: WORLD CLASS PACKAGING
SYSTEMS, INC.
Hilton Head Island, SC 29925-4100 (US)

(72) Inventors:

- Gorlich, Michael P.
Hilton Head Island, SC 29925-4100 (US)
- McPherson, Robert F.
Hilton Head Island, SC 29925-4100 (US)

(74) Representative: Frankland, Nigel Howard et al
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
80801 München (DE)

Remarks:

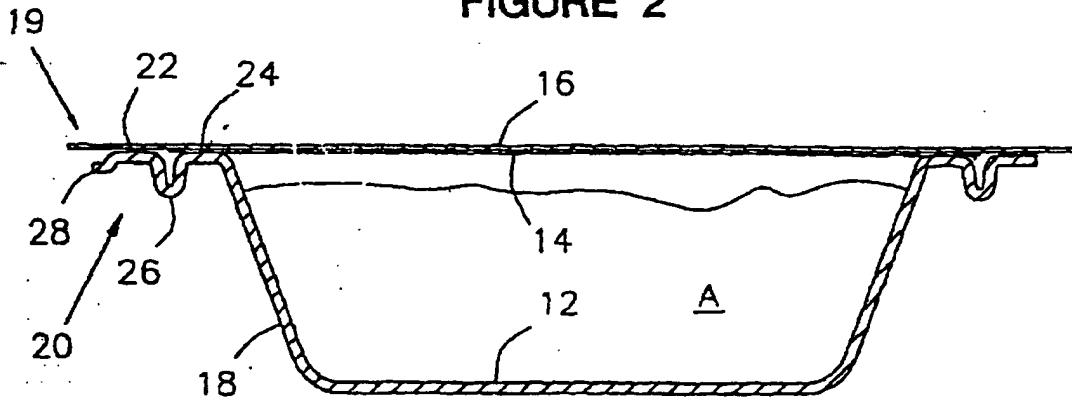
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(54) Package for food product

(57) A package comprises a tray (12) a pliant first
membrane (14) sealed to the tray and a pliant second
membrane (16) sealed to said tray over the first mem-
brane, the membranes being secured at separate loca-

tions on the tray such that said membranes are substan-
tially coplanar with one another, said second membrane
(16) being removable from the tray independently of the
first membrane (14).

FIGURE 2



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Description

[0001] This invention relates to machines for packaging food products, packages and related methods such that the packaged product may be maintained in one condition under certain circumstances and then converted to another condition. For example, during transportation the food package might maintain an inert gaseous atmosphere and then, when the package reaches a supermarket or other retail outlet, the food package will permit exposure of the food product to the ambient atmosphere. While a wide variety of food products can be packaged in accordance with the teachings of this invention, it is particularly advantageous in connection with the packaging of meat in a modified atmosphere package such that the meat may be transported in a relatively inert atmosphere and then caused to bloom when it reaches a retail outlet by exposure to oxygen.

[0002] Historically, meat products have been butchered and packaged in each supermarket or other retail outlet. It has long been recognized that this arrangement is extremely inefficient and expensive. Instead, it would be preferable to permit the meat to be butchered and packaged at an efficient facility which benefits from economies of scale and thereafter shipped to individual supermarkets or other retail outlets.

[0003] In the past, this desirable goal has not been achievable because most consumers prefer to buy meat which is red in color as a result of exposure to oxygen. However, the meat maintains its red color for only one to two days. Thereafter, it turns to a purple color which is undesirable to most consumers. Therefore, if the meat was butchered and packaged in one location and then shipped to another location for eventual sale, by the time the package reached the retail outlet the meat would have undergone the transformation to the purple color and would be effectively unsalable.

[0004] To overcome these problems, there have been a number of efforts to maintain the food product in a first atmosphere during shipping and a second atmosphere when the meat product is ready for retail sale. It is not believed that any of these techniques have yet achieved significant commercial acceptance. Therefore, it is highly desirable to provide a package that would permit remote meat preparation, and subsequent sale several days later.

[0005] One problem is that while the need for such a package is great, consumers may not be willing to invest much money in elaborate packages. Thus, it would be highly desirable to have a package that is convertible between two very different packaging conditions, and yet is very economical. Moreover, it is also advantageous for the package to look similar to packages to which consumers are currently accustomed.

[0006] One attempted solution to these problems is to use a dual layer cover over a plastic package containing the meat product. The upper cover is gas impermeable and may be removed to expose a lower cover that is air

permeable. Thus, the package may be shipped with the upper cover intact so that an inert gaseous atmosphere may be maintained within the package during shipping. Then the upper cover may be removed at the supermarket leaving the lower cover. Since the lower cover is oxygen permeable, it allows the meat to bloom in the presence of oxygen.

[0007] Conventionally, such dual layer packages have been implemented by adhesively securing the upper layer to the lower layer and thereafter heat sealing or otherwise securing both layers to the package itself. For example, when the upper layer is removed the adhesive may be retained on the lower layer, interfering with the ability of the lower layer to pass oxygen. Also, when removing the top layer it may be difficult to avoid tearing or otherwise removing the lower layer. Moreover, it is difficult to produce such a package with controlled delamination of the two layers.

[0008] While various elaborate techniques have been conceived for avoiding the interference between the layers, these approaches generally add cost and complexity to the packaging. Moreover, the removal of the upper layer (which is sealed to the lower layer) without removing the lower layer is problematic. Although attempts have been made to overcome these problems, no commercially viable solution has been achieved.

[0009] Domed meat packages have been used in the past to contain large cuts of meats such as chickens or roasts. However, these packages have suffered from a number of drawbacks.

[0010] It is desirable to control the atmosphere within the meat package to delay the aging of the food product and to extend its shelf life in the supermarket. For example, by providing low oxygen environments, the shelf life of the food product can be extended from a few days to as long as two weeks or more perhaps.

[0011] In order to make the customer feel comfortable with the food packaging, the customer should be able to view a substantial portion of the food product. In order to maintain a desired atmosphere around the package, a package which is somewhat larger than the food product is required. However, with a large, relatively heavy meat product it is difficult to allow for spacing around the food product and yet maintain the product in an attractive fashion within the container.

[0012] Moreover, since the consumer would normally desire that he or she be able to see the food product, the spacing becomes visible to the consumer. The consumer may believe that the package is too large and wasteful. Moreover, if the product is substantially larger than the food product, the food product may move around during transportation and handling, and the package itself may be indented or otherwise damaged.

[0013] In the past, deep draw packages may have been used for this type of packaging. However, deep draw packages become difficult to form at large sizes and may experience significant deformation of the packaging material. These packages are particularly suscep-

tible to the formation of thin spots and to thinning and collapsing of the corner regions.

[0014] Thus, the present applicant has appreciated that it would be desirable to form a domed package rather than to use the deep draw plastic forming technique. With the domed package, the product may protrude above the sealing flanges that connect the upper and lower package portions. It is also possible to form the package portions from different materials adapted to particular packaging needs. For example, it may be desirable to form the bottom portion out of foam material and the top out of transparent plastic.

[0015] The requirements of a relatively large package made of relatively rigid packaging material seem to be incompatible with the necessity of extra space within the package for conventional gas exchange techniques to extend the shelf life. Thus, most conventional, large food products are simply overwrapped with plastic wrap, and the supermarket endures the additional costs that result from meat loss.

[0016] Therefore, it would be highly desirable to provide a relatively rigid domed food package, packaging method, and packaging apparatus which allows relatively large cuts of meat to be efficiently packaged in a desirable gas environment.

[0017] These and other desirable objectives may be achieved by an apparatus for making modified atmosphere packages that includes a plurality of packaging stations. Among these stations is at least one station for loading a food product into a tray. A rotary conveyor moves the trays from one station to the next. The rotary conveyor includes a platform for carrying a plurality of trays. One of the packaging stations is adapted to load the trays on the platform. Another one of the stations is adapted to unload the trays from the platform. An apparatus is included for replacing the ambient atmosphere in the trays with an atmosphere reduced in oxygen content before covering the trays with a packaging film.

[0018] In accordance with another aspect of the present invention, a method for making modified atmosphere packaging includes the step of loading a plurality of trays onto a rotary conveyor. The trays are indexed between a plurality of stations arranged in a circular path. The atmosphere within a tray is withdrawn after a food product has been added. The tray is covered with a film to maintain an atmosphere reduced in oxygen content within the tray. The trays are thereafter unloaded from the rotary conveyor.

[0019] In yet another aspect of the present invention a pliant first membrane is sealed to a tray. A pliant second membrane is sealed to the tray over the first membrane. The membranes are secured to the tray at separate locations on the tray. The membranes are substantially coplanar with one another and are removable from the tray independently of each other.

Figure 1 is a plan view of one embodiment of a package 10 in accordance with the present invention;

Figure 2 is an enlarged side cross-sectional view of the package 10, taken along the line 2-2 of Figure 1;

Figure 3 is a plan view of another embodiment of the package 10 in accordance with the present invention;

Figure 4 is an enlarged side cross-sectional view of the package 10, taken along the line 3-3 of Figure 3;

Figure 5 is a schematic view showing a method for assembling the package 10 of Figure 1;

Figure 6 is a cross-sectional view taken generally along the line 6-6 in Figure 7;

Figure 7 is a front elevational view of the embodiment shown in Figure 6;

Figure 8 is an enlarged top plan view of a portion of the embodiment shown in Figure 6, showing the loading area receiving trays to be packaged;

Figure 9 is a front elevational view of the portion shown in Figure 8;

Figure 10 is a front elevational view corresponding to that shown in Figure 9 after a row of trays has been positioned atop a receiving platform;

Figure 11 is a top plan view of the portion shown in Figure 10;

Figure 12 is a vertical, cross-sectional view partially broken away so as to show two rather than four stations and with vacuum and gas supplying means removed;

Figure 13 is a view corresponding to Figure 12 after the platform has been removed from the rotary arms;

Figure 14 is an enlarged, plan view of the quick disconnect tooling at the station 122c;

Figure 15 is an enlarged, cross-sectional view taken generally along the line 15-15 in Figure 14;

Figure 16 is a partial, side elevational view of the unloading station;

Figure 17 is a partial, side elevational view of the unloading station after a platform has been raised to an "up" position;

Figure 18 is a top plan view of the embodiment shown in Figure 17 after the trays have been pushed onto the unloading conveyor;

Figure 19 is an enlarged, partial, cross-sectional view of the bottom of the surge tank;

Figure 20 is a simplified cross-sectional view showing three stages in one embodiment of a packaging process in accordance with the present invention;

Figure 21 is a partial, enlarged, top plan view of the package shown in Figure 20a;

Figure 22 is a partial, enlarged, top plan view of the package shown in Figure 20b;

Figure 23 is an enlarged, cross-sectional view of one embodiment of a packaging apparatus for accomplishing the process steps shown in Figure 20b;

Figure 24 is an enlarged, cross-sectional view of the packaging apparatus of Figure 23, shown in position to accomplish the process steps shown in Figure 20c; and

Figure 25 is an enlarged, top plan view of another embodiment of the package shown in the position illustrated in Figure 20b.

[0020] Referring to the drawings, wherein like reference characters are used for like parts throughout the several views, a package 10 for containing one or more food products "A" is shown (Figures 1-2). The package 10 is especially advantageous for containing red meat. The package 10 includes a relatively rigid tray 12, a more permeable membrane 14, and a less permeable membrane 16. The membranes 14 and 16 are peripherally connected to the tray 12.

[0021] The tray 12 may be made of a relatively rigid plastic, formed by thermomolding or the like. The tray is preferably made of a material which is gas impermeable, and may be composed of a single polymeric sheet such as polyvinyl chloride, nylon, fluorohalocarbon, polyurethane or a composite of polymeric materials including: PVC; PVC and polyolefin; PVC and saran; PVC and saran and polyolefin; PVC, saran, ethylenevinylacetate copolymer; polystyrene, saran and polyolefin; polystyrene, saran and copolymer; nylon, saran, polyolefin; polyolefin, saran and polyethylene; polyester, saran, polyolefin; polycarbonate, saran and polyolefin; or many other materials which are well known in the art. Advantageously, the tray 12 is preferably formed of a material that forms a good oxygen barrier, has adequate thermoflexibility, is sufficiently strong, and facilitates the attachment of other materials to the tray.

[0022] Although the tray 12 is shown in the illustrated embodiment as being generally rectangular, other shapes of the tray 12, such as a round form (not shown), are contemplated in accordance with the invention. The tray 12 includes a curved base 18 which defines a cavity for receiving the food product A, and a double flanged

edge 20 which extends around the periphery of the base 18.

[0023] The double flanged edge 20 defines a pair of ledges 22 and 24 separated by a trough 26. The outermost edge 28 of the flange 20 may be turned downwardly. In an illustrative embodiment, the base 18 and the flange 20 may be molded as a single piece. In an exemplary embodiment, upper surfaces of the ledges 22 and 24 may be positioned in a single plane, such that the ledges 22 and 24 and the membranes 14 and 16 provide a substantially flat surface on top of the package 10. In this regard, the tray 12 may be formed from a porous, foam-like material that is heat pressed to ensure uniformity in the height of the ledges 22, 24 and the thickness of the tray 12. Such a flat surface facilitates a more reliable connection to the membranes 14, 16, and also permits multiple packages to be easily stacked on top of each other.

[0024] The more permeable layer 14 preferably comprises a flexible, resilient material such as a pliant plastic substance, to permit gaseous exchange therethrough as required by the particular application. In connection with the blooming of red meat, it is generally desirable that the more permeable membrane 14 be highly transmissive of ambient atmosphere. A wide variety of materials are capable of acting as the membrane 14, including polyvinyl chloride, polycarbonate, cellophane, polypropylene, polyethylene, polyethylene copolymers, ionomer film or any other gas permeable materials which are well known in the art. The membrane 14 may also be constructed of microporous films which have holes formed either chemically or mechanically. The membrane 14 need only be sufficiently strong to prevent perforation in use.

[0025] The membrane 14 is secured to the tray 12 at the inner ledge 24. In this regard, it is desirable that the membrane 14 be of a material that is heat sealable to the tray 12. However, it is also possible to adhesively secure the peripheral edge of the membrane 14 to the inner ledge 24. As used herein, the film is "sealed" to the tray, signifying that it is heat fused or adhesively secured to the tray as opposed to being frictionally connected thereto. Between the ledges 22 and 24, a trough 26 is defined. The trough 26 aids in securing the membrane 14 to the inner ledge 24. In particular, after the membrane 14 is stretched over the tray 12 and the ledges 22, 24, the membrane 14 is secured to the inner ledge 24, then trimmed by moving a cutting press downwardly through the membrane 14 and into the trough 26 as explained later. Although the trough 26 has a "U"-shape in Figure 2, it is also understood that the trough 26 may assume a "V"-shape, a semi-circular shape, a rectangular shape, or another suitable shape that may be desired for aesthetic, functional, or other reasons.

[0026] The less permeable membrane 16 also preferably comprises a flexible, resilient material such as a pliant plastic substance. However, the membrane 16 is preferably selected from a group of materials that are

relatively less gas permeable, such as polyester, nylon, cellophane, polypropylene, polyvinyl acetate, saran, or combinations of these materials. Advantageously, the less permeable membrane 16 is impermeable to gases. [0027] The less permeable membrane 16 is removably secured to the outer ledge 22, again by heat sealing, adhesive techniques, or other techniques known in the art. After the less permeable membrane 16 is secured to the outer ledge 22, the membrane 16 may be trimmed by moving a cutting press downward through the membrane 16, at a position outward from the outermost edge 28 as explained later. Alternatively, if desired, the membrane 16 may be trimmed before sealing it to the outer ledge 22. In either case, the membrane 16 is preferably trimmed to leave an overhang 19, to facilitate later removal of the membrane 16 by lifting the overhang 19 and peeling the membrane 16 back from its connection to the outer ledge 22. The less permeable membrane 16, when secured to the ledge 22, is totally free of any connection to the more permeable membrane 14, except frictional connection or indirect connection through the tray 12. This facilitates the convenient removal of the less permeable membrane 16 from the package while leaving the more permeable membrane 14 in place and undisturbed. Although the membranes 14, 16 are not connected to each other, the membranes 14, 16 are substantially coplanar to each other, in face to face abutment, each advantageously being under slight resilient tension.

[0028] After both the membranes 14 and 16 are secured to the tray 12, a desirable atmosphere may be maintained within the package 10 for the benefit of the food product A contained therein. This may be done by sealing the package closed in the desired atmosphere. In the case of red meat products, the initial atmosphere in some embodiments may contain a relatively low concentration of oxygen. For example, gases including substantial concentrations of carbon dioxide or nitrogen may be maintained with the package to reduce the exposure of the food product A to oxygen. In the case of meat products, this forestalls the blooming of the meat product until a later time.

[0029] When the product reaches a supermarket or other retail outlet, it may be desirable to remove the less permeable membrane 16. This is conveniently done by grasping the edge of the upper membrane 16 and pulling it upwardly. Since the membrane 16 is not connected to the membrane 14, it may be easily removed from the remainder of the package 10.

[0030] Thereafter, the package 10 exists without the less permeable membrane 16, and includes only the more permeable membrane 14 and the tray 12. In embodiments containing meat products, it may be desirable to allow oxygen transmission through the more permeable membrane 14 to cause blooming of the meat product. Thus, in the store, once the less permeable membrane 16 has been removed, the red meat product A can be caused to turn red or bloom in the presence

of a higher concentration of oxygen.

[0031] In an alternate embodiment, both membranes 14, 16 may be formed from substantially impermeable materials, for use in certain applications. This arrangement may be useful, for example, to provide alternative labeling schemes. With such an embodiment, the lower membrane may contain a label of a supermarket or other retail store, such as an advertising label; the upper membrane, on the other hand, may display a label from an initial meat packer, providing instructions to the retail butcher rather than the ultimate buyer of the meat. Then the outer membrane 16 may be easily removed relative to the inner membrane 14.

[0032] Referring to Figures 3-4, an alternate embodiment of the package 10 will be described. In particular, this embodiment contemplates a ledge 52, surrounded by a recessed lip 54 having an outermost edge 56. In this embodiment, the more permeable membrane 14 is first secured to the ledge 52, and then trimmed by moving a cutting press downwardly through the membrane 14 at a position radially outward from the ledge 52, as permitted by the recessed lip 54. Subsequently, the less permeable membrane 16 is stretched over the tray 12 and adhered to the lip 54. The less permeable membrane 16 is trimmed by moving a cutting press (not shown) downward through the membrane 16 at a position outward from the outermost edge 56. Thus, the less permeable membrane 16 is provided with a larger surface area than the more permeable membrane 14, such that the membrane 16 overlaps the membrane 14. The membrane 16 may be cut to provide an overhang 58, such that the less permeable membrane 16 may be easily removed by lifting the overhang 58 and peeling the membrane 16 back from its connection with the edge 56. Moreover, the membranes 14, 16 are substantially coplanar with each other, in face to face abutment, each being under slight resilient tension.

[0033] In this embodiment, the desired atmosphere may be maintained within the package 10, in the same manner as described above in conjunction with the previous embodiment. When the product reaches a supermarket or other retail market, the less permeable membrane 16 may be removed by conveniently grasping the overhang 58 of the membrane 16 in pulling it upward. Thereafter, the package 10 exists without the less permeable membrane 16 and includes only the more permeable membrane 14 and the tray 12, as with the embodiment described previously.

[0034] Referring to Figure 5, an exemplary process for forming the package 10 will be explained. Starting at the right side of Figure 5, a tray 12, held from below in a rigid conforming carrier 60, is filled in a conventional fashion with a food product A. Next, the package 10 is evacuated of oxygen and gas back-filled with a transportation gas which is lower in oxygen content. A web 70 of the more permeable membrane 14 is unwound from a pair of rolls 62 and 64 and positioned over the tray 12. The more permeable web 70 is secured to the

inner ledge 24, for example by a heat sealing machine 66. Thereafter, a conventional cutting process 68 is used to cut the web 70. In the embodiment of Figures 1-2, the web 70 is cut at a position adjacent to the trough 26. With the product of Figures 3-4, the web 70 is cut at a position over the recessed lip 54, the lip itself acting as a trough or depression. In either case, it should be clear that the trough 26 or lip 54 facilitates the removal or cutting of the membrane 14 from the web 70 in place on the package 10. The web 70 may also be severed by using heat or ultrasonic energy or the like.

[0035] At the next station, a web 76 of the less permeable material 16 is unrolled from a pair of rolls 72, 74 so that the less permeable web 76 may be positioned on the package 10. In the embodiment of Figures 1-2, the less permeable web 76 is secured to the ledge 22. In contrast, in the embodiment of Figures 3-4, the less permeable web 76 is secured to the outermost edge 56. In either case, this securing is performed using conventional techniques, such as using a heat sealing machine 42. At this point, the transportation gas is sealed inside the package 10. Finally, the web 76 is cut by conventional cutting equipment 78. In the embodiment of Figures 1-2, the cutting occurs slightly outward from the edge 28. In the embodiment of Figures 3-4, the cutting occurs slightly outward from the outer edge 56. This leaves an overhanging piece 19 or 58 of the less permeable material 16 which may be grasped by the user to remove the membrane 16 when desired.

[0036] When the package 10 has been assembled, the package may be shipped to locations for retail sale. At the retail establishment, the package is held until the package is ready to be displayed. At that point, the less permeable membrane 16 is peeled away and discarded. After a short holding period, the package may be displayed for retail sale. The holding period is necessary to allow the package to absorb oxygen through the more permeable membrane 14. After the meat product has bloomed, it can be displayed for retail sale.

[0037] It can be understood that through the provision of the trough 26 or lip 50, both membranes 14, 16 may be attached to the same tray 12 in a fashion that permits high speed manufacture. While the simplified process depicted in Figure 5 suggests that the material may be packaged in a serial fashion, this approach would likewise apply to conventional packaging equipment.

[0038] Advantageously, the more permeable membrane is sufficient to maintain the desired gaseous environment in the package until the less permeable membrane is in place. This is especially true with high speed systems. However, in some circumstances it may be useful to provide a particular gaseous atmosphere between the stations where the more permeable and less permeable membranes are applied.

[0039] The same process can be used to make a package wherein both membranes are substantially impermeable.

[0040] A packaging machine 120, as shown in Figure

6, includes four stations 122. While the machine is illustrated in a four-station embodiment, it should be understood that one or more of the indicated stations may be unused and that in any particular embodiment it may be possible or desirable to have more or less than four stations. The four stations 122 operate on packages which are moved circularly from one station to the next.

[0041] The packages to be produced are held on a platform 124 which in the illustrated embodiment includes slots 126 to receive four package trays. A variety of package types may be utilized including those described herein.

[0042] The platforms 124 are carried on mounting arms 128 which in turn connect to rotatable ring 130. The ring 130 is driven by the mechanism 132 which may be of any conventional type but is illustrated as being a drive chain and motor arrangement.

[0043] The entire machine 120 is supported atop a base 134 on feet 136, as shown in Figure 7. Base 134 also supports a surge tank 138, which in turn supports a hanger assembly 140. The surge tank 138 provides a central support for mounting the ring 130 and drive mechanism 132. The base 134 and hanger assembly 140 may be utilized to support various equipment positioned at the stations 122 for operating on the food trays contained within the platform 124. For example, as shown in Figure 7, a tray load mechanism 142 is associated with the station 122a and supported on the base 134. Similarly, a tooling assembly 144 includes an upper

portion 146 mounted on the hanger 140 and a lower portion 148 mounted on the base 134. The upper portion 146 includes a housing or chamber 147 and the lower portion 148 includes a housing or chamber 149.

[0044] The tray load mechanism 142, shown in Figure 10, includes a tray conveyor 150 and a tray loader 152. The conveyor 150 may be a conventional belt conveyor wherein the trays 155 are motioned onto the tray conveyor 150. They are aligned by a stop bar 154 powered by a cylinder 156. At the appropriate interval, the trays 155 may be advanced to a second stop bar 158 so that the position previously occupied by the trays 155 may be filled by additional trays. The stop bar 158 is controlled by a second cylinder 160. The trays 155 may be pre-loaded with the food product to be packaged.

[0045] Below the platform 124a, there is a cylinder 162 that powers a bed 164 upwardly and downwardly. The bed 164 includes a stop 166 on its inward end. Each bed 164 is designed to receive a tray 155 from the tray conveyor 150 and to lower it into a platform slot 126. Thus, there would be a plurality of mechanisms 160 and 164, one for each of the slots 126 in a platform 124a.

[0046] In the illustrated embodiment, the station 122b is an inactive station which is not used. However, in the other applications, it may be desirable or necessary to perform all or part of the operation which is done at another station at the station 122b. The station 122b could be used, for example, to load the food product into the trays 155.

[0047] The station 122c includes a tooling assembly 144 made up of an upper portion 146 and a lower portion 148. As shown in Figure 7, the upper chamber 147 is mounted on a mechanism 168 which allows it to be raised and lowered towards and away from the platform 124. Likewise, the lower chamber 149 is mounted on a mechanism 170 which raises and lowers the lower portion 148 towards the underside of the platform 124. If desired, either the upper chamber 147 or lower chamber 149 may be stationary.

[0048] The mounting of a platform 124 on the arms 128 is shown in Figures 12 and 13. As shown in Figure 12, the platform 124 is mounted on the arms 128 by a plurality of upstanding pins 172. Each pin 172 includes a tapered upper portion 174 which fits in a mating tapered portion 176 in the underside of the platform 124. Thus, the platform 124 is removably located on the arms 128 by way of the pins 172.

[0049] The lower chamber 149 includes a pair of upstanding pins 178 with tapered portions 180 which mate in holes 182 in the platform 124. Thus, when the lower chamber 149 moves upwardly to engage the platform 124, the tapered portions 180 of the pins 178 mate with the holes 182 in the platform 124. In this way, the platform 124 is very precisely centered and positioned within the station 122c. As shown in Figure 13, the lower chamber 149 actually lifts the platform 124 off of its pins 172 to achieve the precise alignment. The upper chamber 147 and lower chamber 149 contain seals 184 which provide an air tight seal with the upper and lower surfaces of the platform 124, again as shown in Figure 13.

[0050] The configuration of the upper and lower portions 146 and 148 of the tooling assembly 144, shown in Figure 15, includes a sealer 186, a cutter 188, and a web winding system 190. The web 192 may be unrolled from a roll 194, processed inside the tooling assembly 144 and transferred to a waste roll 196. The film 192 may be made of any plastic film used for food packaging including composite films of plastic, aluminum foil, paper, or cardboard.

[0051] With the film 192 positioned over the tray 155, it may be sealed by the sealer 186 which is mounted on a shaft 208. The seal bar may be telescopically reciprocated up and down at the appropriate times in order to seal the film 192 to the tray 155. A wide variety of sealers 186 may be utilized, however one conventional sealer uses electrical resistance heaters 200 in order to heat seal the film to the tray 155. The extent of upward and downward movement of the shaft 208 is controlled by the medial stops 202 under the influence of a conventional fluid energy source. The medial stops 202 are part of a tube 198 which is sealing secured to the shaft 208.

[0052] The sealer 186 may be removed from the mechanism for repair or cleaning when desired simply by unthreading the nut 206. When this is done, the shaft 208 and sealer 186 may be removed downwardly from the mechanism.

[0053] The cutter 188 includes a pair of blades 210

positioned to enter the recess 212 in the platform 124. These blades cut the film 192 completely around the upper circumference of the tray so that it conforms to the configuration of the tray 155. Of course, any conventional severing technique may be utilized including cutting or heat severing. Also, more than one web or film may be severed for attachment to the tray 155. Like the sealer 186, the cutter 188 reciprocates upwardly and downwardly around the sealer 186. It is controlled by stops 214 on arms 216 under the influence of a conventional fluid energy source.

[0054] The cutter 188 also includes an internal coolant circulation passage 218. Connected to a source of external cooling liquid, the passage 218 provides a medium for cooling the cutter 188. The cutter 188, in close proximity to the sealer 186, is subject to possible heat related malfunctions. By cooling the cutter 188, the precision of the cutting operation may be maintained even in a relatively hot environment.

[0055] The lower chamber 149 contains a gas exchange passage 230 in its lower surface, while the upper chamber 147 includes a gas exchange passage 232 in its side wall. The lower portion 148 may include filler 234. Each platform 124 includes a plurality of gas exchange passages 236. The gas exchange passage 232 communicates with a vacuum source by way of the quick disconnect device 238, shown in Figure 14. That device is secured to the upper chamber 146 by threaded knobs 240. Similarly, device 242 is connected by threaded knobs 244 to lower chamber 149 to provide gas exchange via opening 230.

[0056] Referring to Figure 14, it is evident that the connections to the upper and lower portions 146 and 148 are all of the quick disconnect variety so that the machinery associated with any particular station 122 may be readily removed from the remainder of the machine 120. Moreover, the connections for power and fluid may likewise be of the quick disconnect variety. Thus, the connections such as those shown at 220 may be disconnected by simply pulling them apart or unscrewing them and then the mechanisms 246 holding the upper and lower chambers 147 and 149 may be disconnected in the same fashion so that the upper and lower chambers 147 and 149 may be quickly removed.

[0057] The unloading station 122d, shown in Figure 16, includes an unloading conveyor 226 and a tray pusher 228. At the appropriate time, the trays 155 in a platform 124 are pushed upwardly by the cylinder 230 of the pusher 228. Then the trays are pushed laterally by the slider 232 powered by cylinder 234. The trays are pushed onto the conveyor 226 as indicated in Figure 13.

[0058] The machine is operated generally as follows. Initially, a plurality of trays 155 are organized on the conveyor 150 of the tray load assembly 142. As indicated in Figures 8 and 9, the trays are formed into two rows of four trays through the operation of the stop bars 154 and 158. Trays are originally allowed to ride up against stop bar 158 so that they slide relative to the rotating

conveyor 150. A second row of trays then back up to the first row of trays.

[0059] As shown in Figures 10 and 11, at the appropriate time, the second stop bar 158 is lowered allowing the first row of trays to pass on to the bed 164. Each bed 164 is thereafter lowered so that each tray 155 is held in a slot 126 in the platform 124.

[0060] After a passage of time, the platform 124 is rotated 90 degrees to the station 122b. Thereafter, the stop bar 158 is operated to allow the second row of trays 155 to be loaded into a subsequent platform 124 rotated into station 122a from station 122d. From station 122b, the platform 124 rotates into the station 122c as shown in Figure 6.

[0061] As shown in Figures 12 and 13, at the tooling assembly 144, the platform 124 is lifted from its supports 172 and held between the upper chamber 147 and lower chamber 149 of assembly 144. Precise alignment is achieved through the operation of the pins 178 which engage mating holes 182 in the platform 124. The tapered portions on the pins 178 and holes 182 interact to guide the platform into the desired portion within the station. In this way, the trays 155 are precisely positioned with respect to the tooling assembly.

[0062] After the platform 124 is in position, a vacuum is drawn in the upper chamber 147 through the gas exchange passage 232. This is possible since the upper chamber 147 sealingly engages the film 192 through o-ring seals 184. After the drawing of a vacuum is begun in upper chamber 147, a vacuum is begun to be drawn in the lower chamber 149 via a vacuum tube 239. This is possible because the lower chamber 149 sealingly engages the platform 124, against the upper chamber 147, through an o-ring seal 184.

[0063] As a result, good fluid communication is achieved with the exterior of the tray 155, under the film 192. This is because the vacuum in the upper chamber 147 lifts the film 192, allowing air to be exhausted from the tray 155 through a series of holes on slots 250 in the bottom of recess 212 of the platform and out the opening 230. The provision of the filler 234 makes this process proceed more quickly.

[0064] After the vacuum is drawn, a desired atmosphere is then pumped into the tray via the openings 257 and 236 from the gas tube 237. This atmosphere is preferably one which is reduced in oxygen content to extend the life of the packaged food product.

[0065] As shown in Figure 15, the film 192 may be heat sealed to the tray 155 using the sealer 186. This operation may be a conventional heat sealing operation. The sealer 186 reciprocates downwardly under the control of the stops 202 in response to changing fluid pressure in the chamber 203.

[0066] After the film 192 is sealed to the tray 155, the film is cut by cutter 188. The cutter 188 reciprocates downwardly to cut the film 192, eventually entering the recess 212. The movement of the cutter 188 is controlled by the fluid pressure in the chamber 217. In this way

the desired atmosphere may be sealed into the package. Of course, other gas exchange techniques may be utilized as well. Advantageously, the atmosphere inside the assembly 144 is reduced in oxygen content so that the food product will have a longer useful life.

[0067] The operation of the cutter 188 may be adversely affected by the ambient heat within the assembly 144 which is greatly augmented by the heat created by the heat sealing operation. This heat may distort the cutting blades and cause inaccuracies therein. For this reason, a source of cooling fluid, for example water, may be circulated through the passage 218 so as to cool the cutter 188.

[0068] After this operation is complete, the upper chamber 147 and lower portion 149 may be moved apart and the rolls 196 and 194 advanced so as to bring a new section of film into position between the chambers 147 and 149. Trays 155 are then advanced to the next station 122d.

[0069] As shown in Figure 16, in station 122d the trays 155 are positioned over the tray pushers 228 and cylinders 230. At the appropriate time, one or more trays 155 are pushed upwardly through the action of the cylinders 230 and pushers 228 as shown in Figure 17. Thereafter, the trays may be pushed laterally by the slider 232 and its cylinder 234 as shown in Figure 18. Then the trays may be taken away from the rotary conveyor by the unloading conveyor 226.

[0070] The entire operation is facilitated by the rotary arrangement of the stations 122. The operation of the conveyor is continuous since it is laid out in the rotary arrangement. In this way, problems arising from the need to return the platforms 124 to the initial position at the end of a linear conveyor are eliminated.

[0071] Moreover, with the rotary arrangement the central area may be occupied by the conveniently located surge tank 138. This tank supplies a source of fluid pressure for the various operations in the surrounding rotary conveying apparatus. The tank 138 is normally closed by caps 254 on both ends. As shown in Figure 19, a drain 252 is provided at the bottom of the surge tank 138 for releasing a sanitizing solution. The drain may be closed by a removable cover 256. The interior of the tank 138 may be washed with the bacteriostatic solution to minimize bacteria transfer to the packaging. The tank 138 also provides the support for the drive mechanism 132 and rotatable ring 130.

[0072] In addition, because of the rotary arrangement of the conveyor, any particular station may be easily accessed for removal from the rest of the machine. Any particular station may be easily replaced with a more appropriate station for any particular operation. Also, a malfunctioning apparatus may be replaced with a working apparatus. Because of the rotary arrangement, access to the individual stations for repair is facilitated.

[0073] Repair and replacement is also facilitated by making the various connections to the stations for electrical and fluid power of the quick disconnect variety.

Moreover, by making the means of attachment of the particular apparatus to each station of a quick disconnect variety it is possible to change stations quickly to convert the machine for other uses or to replace a broken piece of equipment.

[0074] A packaging process for packaging a large meat product "A" is shown in Figure 20 and includes the steps a, b, and c. In step a, the food product "A" is shown contained within a dish-shaped plastic package portion 310 which is supported by a peripheral flange 312 on a member 314.

[0075] The package portion 310 may be formed of a variety of conventional materials including any known plastic packaging material. In many instances, it may be desirable to form the lower package portion 310 of molded foamed plastic so that the package portion will be relatively rigid.

[0076] Referring to Figure 20, step b, an upper package portion 318 is shown in spaced relation to the lower package portion 310 over the food product "A". The package portion 318 is domed and includes a peripheral flange 320. Like the package portion 310, the upper package portion 318 may be formed of a variety of conventional plastic materials. However, in many instances, it may be desirable to form the upper package portion 318 out of relatively rigid, molded transparent plastic material. This allows the food product "A" to be viewed within the food package. Advantageously, both the portions 310 and 318 are preformed of relatively rigid, molded plastic material.

[0077] As shown in Figure 20, step c, the upper and lower package portions 318 and 310 may be joined along their peripheral flanges 320 and 312 by an apparatus 322 which presses the flanges 320 of the portion 318 downwardly onto the flanges 312 of the package portion 310. If desired, the apparatus 322 may be a heat seal machine which causes heat sealing of the juxtaposed flange portions thereby connecting the materials.

[0078] The advantage of holding the upper domed portions 318 in spaced juxtaposition with the lower portion 310 is that the gaseous environment within the package may be transformed prior to the sealing step c shown in Figure 20. For example, the air inside the package may be exhausted, and a desired gas may be supplied in its place. The desired gas may be one which is relatively low in oxygen content so that the shelf life of the food product may be extended. For example, the gas may be relatively higher in either carbon dioxide and/or nitrogen than normal atmospheric air in order to prevent or diminish the oxidation processes that shorten the life of the meat product "A".

[0079] As shown in Figure 21, the lower package portion 310 may be maintained in a desired arrangement by a set of two pairs of opposed guides 324. Each of the guides 324 is arranged in a substantially tangential arrangement to the curved sides of the lower package portion 310 so as to abut with the sealing region 326. The sealing region 326 provides the point of attachment to

the upper package portion 318. It can also be seen in Figure 21 that the lower package portion 310 may include an outwardly extending flange portion 328 on either of two opposed ends of the package 310. While the package 310 shown in Figure 21 has an oblong configuration, the cross-sectional configuration of the package may assume one of a variety of different shapes.

[0080] Figure 22 shows the positioning of the upper package portion 318 over the lower package portion 310. The upper package portion 318 includes a pair of opposed bluntly pointed end flanges 334 which interact with and are constrained between each set of guides 324. The outwardly extending flange portions 334 extend over the tubes 330 such that the tubes 330 do not generally guide the positioning of the upper package portion 318 in the horizontal plane. This accomplished substantially by the guides 324. In the regions 336, the flanges 334 extend past the edges 332 of the flanges 328 so that there is a region of overhang of the flange 334 over the lower package portion 310.

[0081] Figure 23 shows a packaging machine for achieving the package operation shown in Figure 20. In order to illustrate that a variety of package shapes may be utilized, the package 338 shown in Figure 23 is of a slightly different shape than the package shown in Figure 20. In particular, the lower package portion 310 is deeper than the package portion 310 shown in Figure 20, and the abruptness of both the lower and the upper package portions 318 and 310 is greater in the embodiment shown in Figure 23.

[0082] The lower package portion 310 rests in a conforming tray 340 which conforms to its outside configuration and supports the flange 312. The upper package portion 318 has its flange portion 336 resting atop the filling tube 330.

[0083] The filling tube 330 is reciprocal up and down within a slot 342. However, the extent of its upward extension is controlled by the overhanging edge 344 of the adjacent guide 324. Each tube 330 includes an outer cylinder 330a and an inner cylinder 330b.

[0084] The outer cylinder 330a includes a set of "O" rings 346 which prevent leakage around the tube 330. A pin 348 is provided to control the extent of downward movement of the tube 330 and to prevent its rotation about its lengthwise axis. Within the center of the tube 330 is a bore 350 which is capable of conveying gas to or from the interior of the package to or from the passageway 352. Thus, gas may pass via the passageway 352 to or from the interior of the package shown in the configuration of Figure 23.

[0085] A pressurized gas supply passageway 372 is connected to a source (not shown) of pressurized gas. When desired, pressurized gas may be communicated via the passageway 372 to act on the lower end of the outer cylinder 330a. This causes the tube 330 to move to its upper position shown in Figure 23.

[0086] Juxtaposed over the upper package portion 318 is a pusher bar 354 and a sealing bar 356. The seal-

ing bar 356 may be a conventional heat sealing bar which heats all the flanges of the upper package portion 318 to those of the lower package portion 310.

[0087] The vacuum chamber cover 390 seals to the lower chamber 392 through inner and outer peripheral seals 394 and 396 and the abutment of gasket 398 on the lower chamber 392. A valved passage 400 is provided for pulling a vacuum inside the chamber defined by the cover 390.

[0088] Figure 25 shows an alternate embodiment in which a gas exchange system is provided on the upper package portion 318. The gas exchange portion 358 is constructed generally as described previously. The portion 358 includes one or more holes 360 formed in the package portion 318. These holes are covered by a first circular plastic film layer 362 which may be permeable to atmospheric air. The layer 362 is sealed to the package portion 318 at 364. Attached over the portion 362 is an upper fluid impermeable plastic film 366 which is sealed at 368 to the upper package portion 318. When desired, the layer 366 may be peeled away to allow gas exchange through the lower layer 362 via the holes 360.

[0089] The method and apparatus of the present invention may be implemented in the following fashion. The lower package portion 310, loaded into the conforming tray 340, is supported by its flanges 312. Then a meat product "A", if not already loaded, may be loaded inside the package portion 310. Next, the relatively rigid top or upper portion 318 is aligned over the lower package portion 310 but resting on the top of the filling tubes 330 as shown in Figure 23.

[0090] Initially, the air within the package is exhausted through both the passage 400 and the bore 350 to the passageway 352. Then, with the passage 400 closed, a desired gaseous environment is passed through the passageway 352 and the bore 350 into the package. This gaseous environment may be one which is relatively poor in its concentration of oxygen and relatively higher (with respect to normal ambient atmosphere) with respect to its carbon dioxide and/or nitrogen content. The result of such an environment is to extend the shelf life of a meat product. This is because the presence of oxygen causes the meat product to age and discolor.

[0091] After the desired environment has been established, the gas filling tubes 330 are pushed downwardly by the pusher bar 354 into their passageways 342 until the pins 348 engage the top of the slots 380. In this position, shown in Figure 24, the upper package portion 318 is in abutment with the lower package portion 310. At this point, the sealing regions 326 are likewise in abutment. The package is thereafter sealed along the regions 326 of the upper and lower package portions 310 and 318 to provide an air tight seal between the two package portions. This is accomplished through the sealing bar 356 which may, in one advantageous embodiment, cause heat sealing of the components together. The sealing bar 356 reciprocates with the pusher bar 354. However, the pusher bar 354 pushes the tubes 330

below the flanges to insure that, regardless of the package thickness, the tubes 330 do not interfere with the sealing process.

[0092] The completed package 338 may be removed by raising the cover 390 with the sealing bar 356 and pusher bar 354. The package 338 may be removed from the conforming carrier 340. This may be accomplished in batch or continuous fashion as desired.

[0093] The cycle may be repeated after the gas tubes 330 are reciprocated to their upper position. This is achieved by supplying air pressure to the upper cylinders 330a. The air pressure is released through a relief valve (not shown) when the tubes 330 are pushed downwardly by the pusher bar 354.

[0094] The positioning of the upper and lower packaging portions 310 and 318 with respect to one another is assured by the provision of the guides 324 and the filling tubes 330 which interact with the special package shape to ensure exact juxtaposed position of the parts relative to one another. Moreover, the flange portions 336 of the upper package portion 318 maintain the separation of the package when they abut with the filling tubes 330.

[0095] Firstly, the lower package portion 310 is inserted into the conforming carrier 340, guided by tubes 330 and guides 324. Then, the upper package portion 318 is located on the tubes 330, positioned by the guides 324. Thereafter, the cover 390 is closed and the process may be repeated.

[0096] In many applications, particularly those involving red meat, it may be desirable to withdraw the low oxygen atmosphere from the container at the point of sale. Otherwise, the package with its low oxygen environment will cause the meat to have a purplish color. Thus, in the supermarket, the upper fluid impermeable film 366 may be peeled back. This allows ambient atmosphere to enter the package so that the meat will take on a reddish color.

[0097] The provision of the overhang 336 of the upper package portion 318 over the lower package portion 310 facilitates the removal of the domed upper package portion 318 in use. Moreover, the concealed location of the overhang 336 diminishes the possibility of accidental opening.

[0098] Thus, it is apparent that there has been provided, in accordance with the invention, a package, a method, and a packaging apparatus that satisfies the aims, objects, and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such embodiments, alternatives, modifications, and variations that fall within the spirit and broad scope of the appended claims.

Claims

1. A package comprising:
 - a tray;
 - 5 a pliant first membrane sealed to said tray; and
 - a pliant second membrane sealed to said tray over said first membrane, said membranes being secured to separate locations on said tray such that said membranes are substantially co-
planar with one another, said second membrane being removable from the tray independently of said first membrane.
2. The package of Claim 1, wherein said tray includes 15 a peripheral flange including a ledge and a recessed lip surrounding the ledge to secure the first and second membranes, respectively.
3. The package of Claims 1 or 2, wherein said tray includes a pair of substantially coplanar sealing ledges for securing said first and second membranes. 20
4. The package of any one of the preceding Claims, wherein the second membrane is less permeable 25 than the first membrane to gases.
5. The package of any one of the preceding Claims, wherein the first and second membranes comprise a resilient material. 30
6. The package of any one of the preceding Claims, wherein said first and second membranes comprise a substantially impermeable material. 35
7. The package of any one of the preceding Claims, wherein the tray comprises a foam, said ledges being pressed to substantially uniform thickness.
8. The package of any one of the preceding Claims, 40 wherein the first and second membranes are only connected by way of said tray.
9. The package of any one of the preceding Claims, including a pair of sealing surfaces for receiving said first and second membranes, there being provided a recess between said surfaces designed to facilitate the severing of the first membrane from a web in place on the tray during manufacture of the package. 45
- 50
10. The package of any one of the preceding Claims, wherein said second membrane is peelable from said tray. 55

FIGURE 1

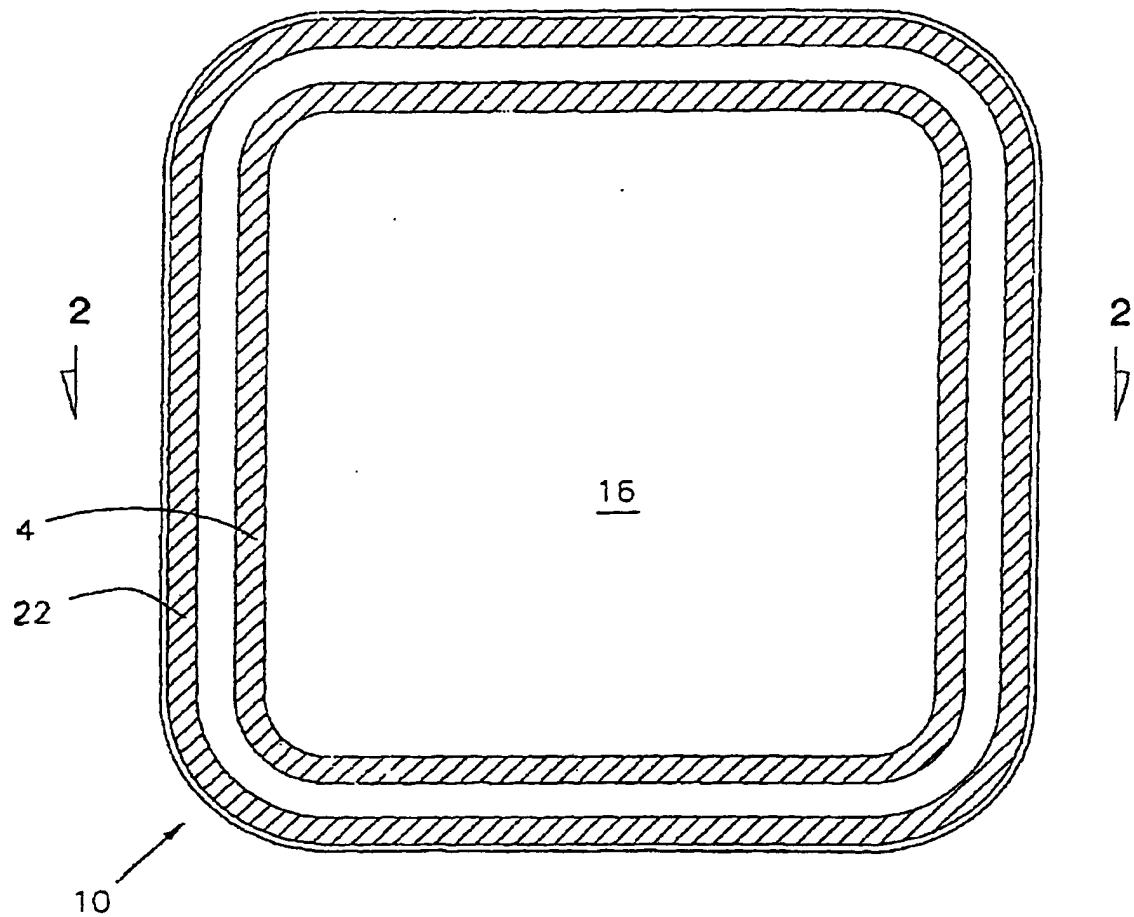


FIGURE 2

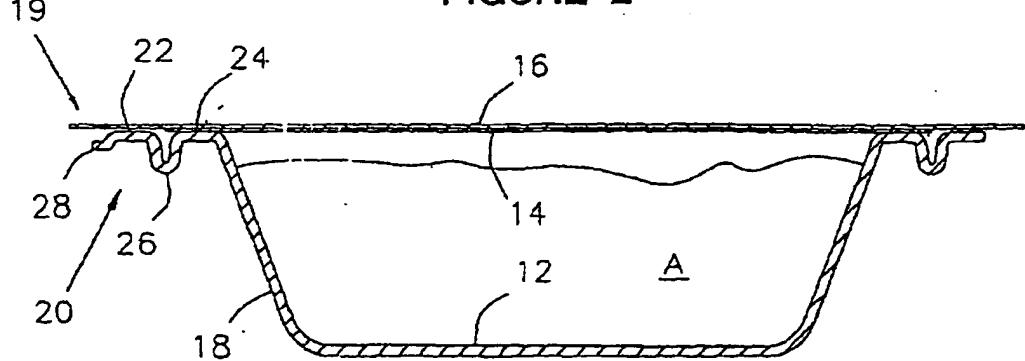


FIGURE 3

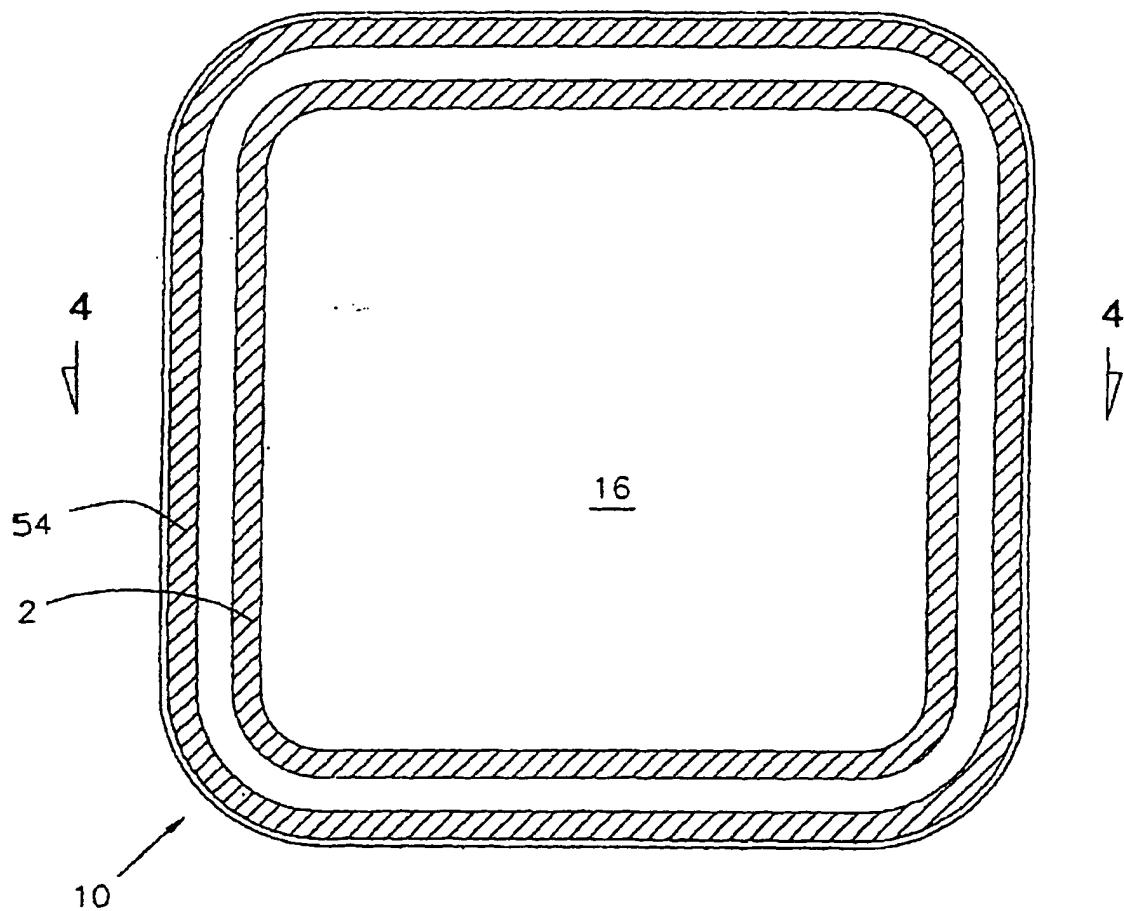


FIGURE 4

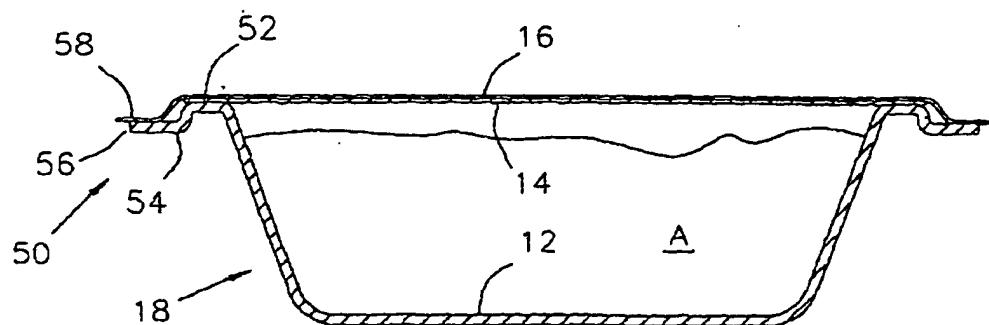


FIGURE 5

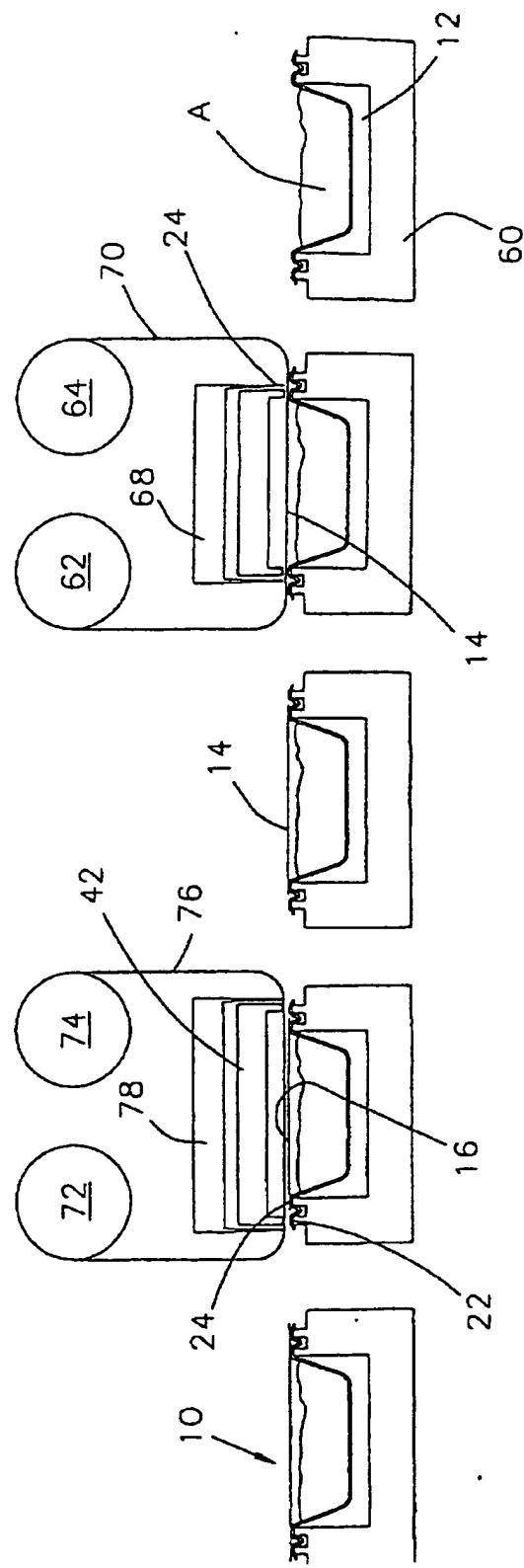


FIG 6

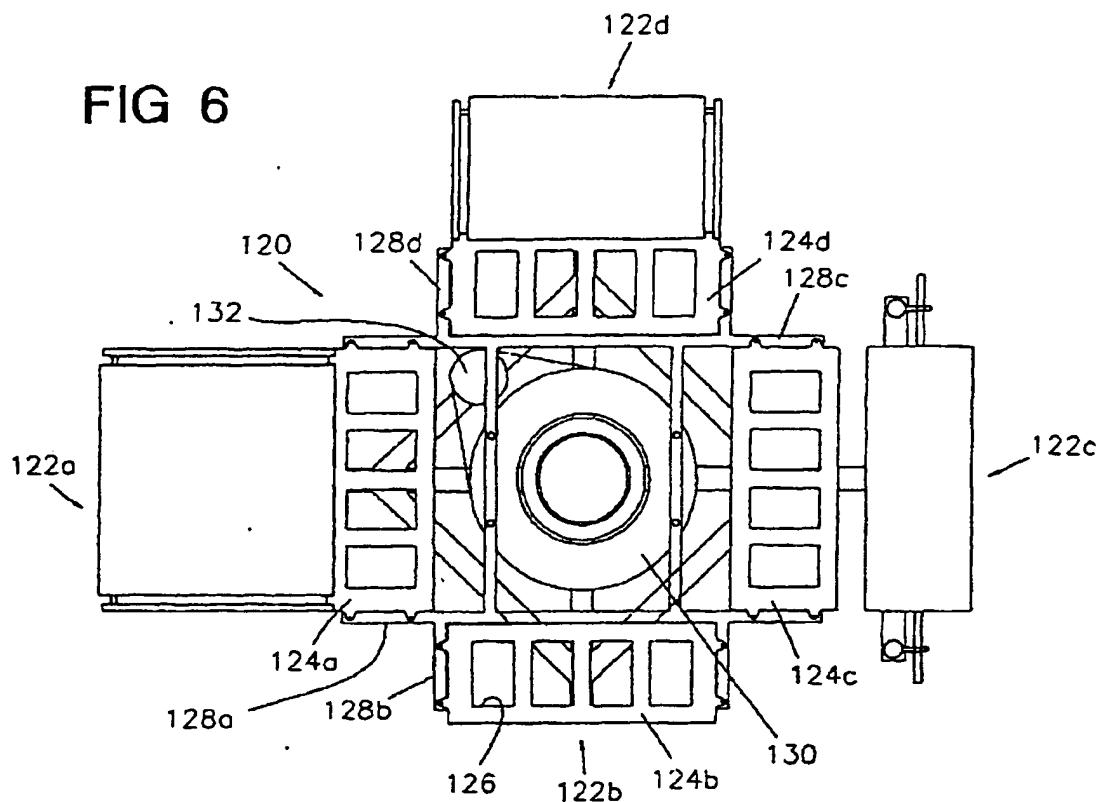


FIG 7

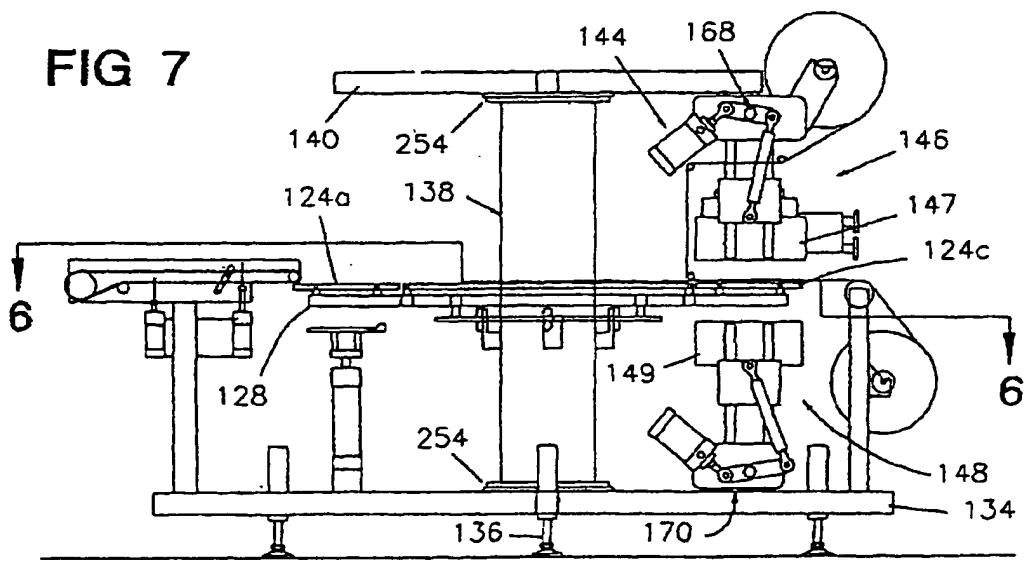


FIG 8

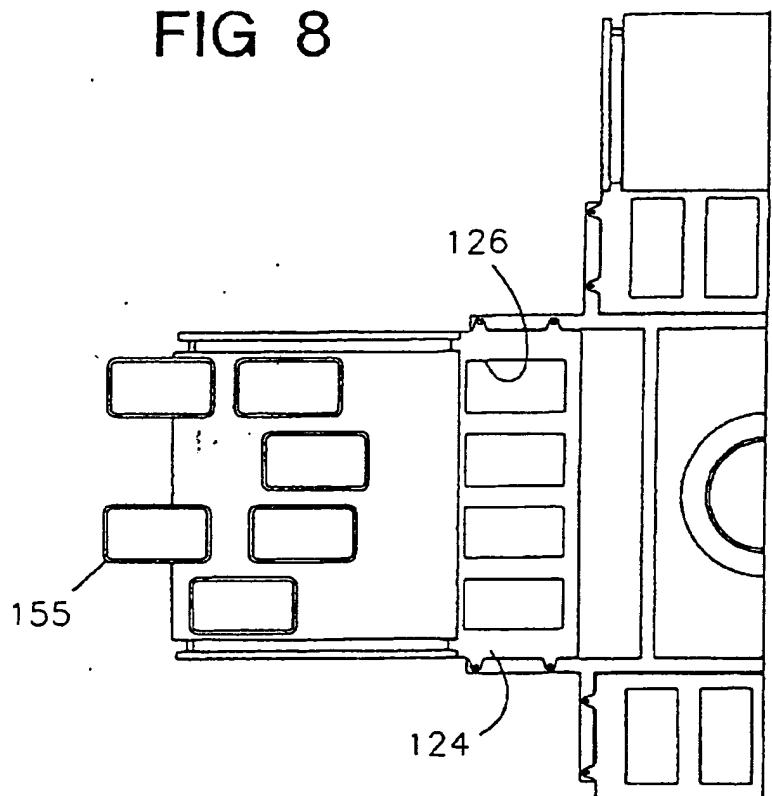


FIG 9

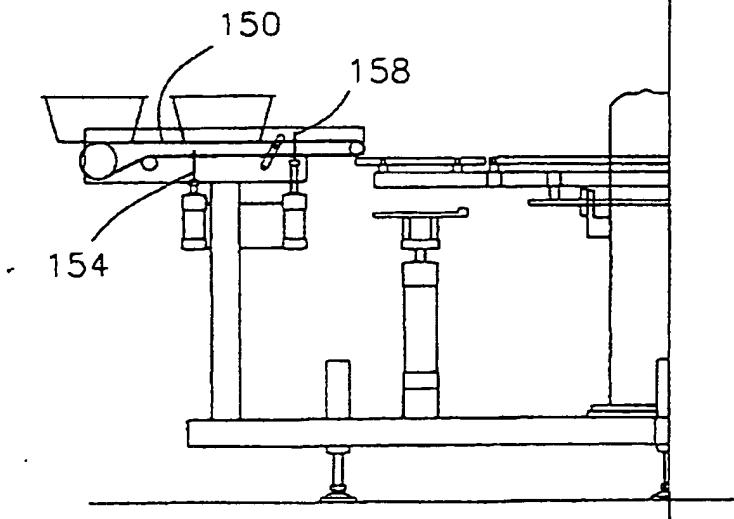


FIG 10

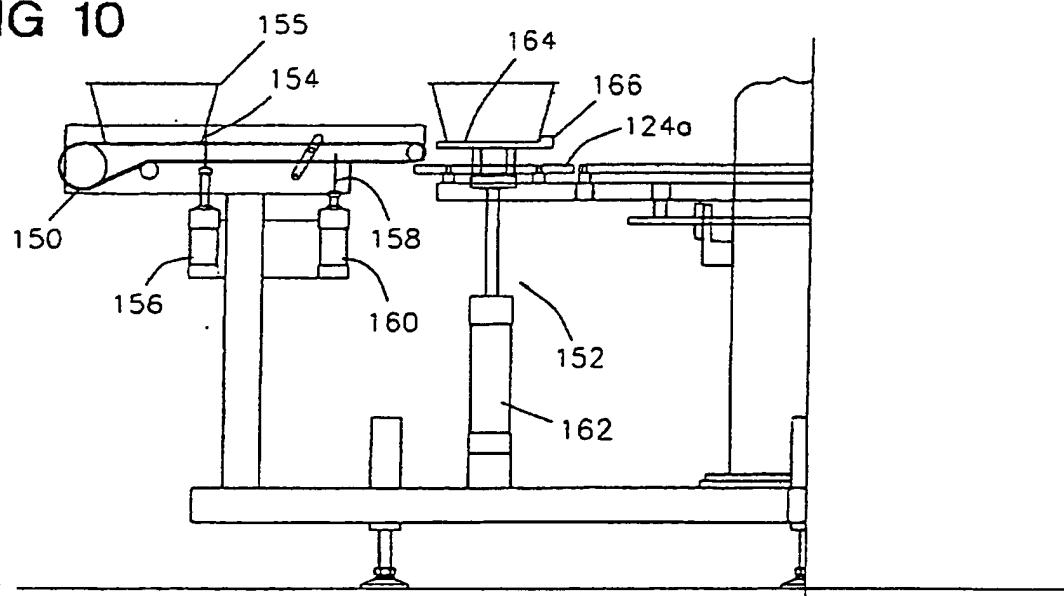


FIG 11

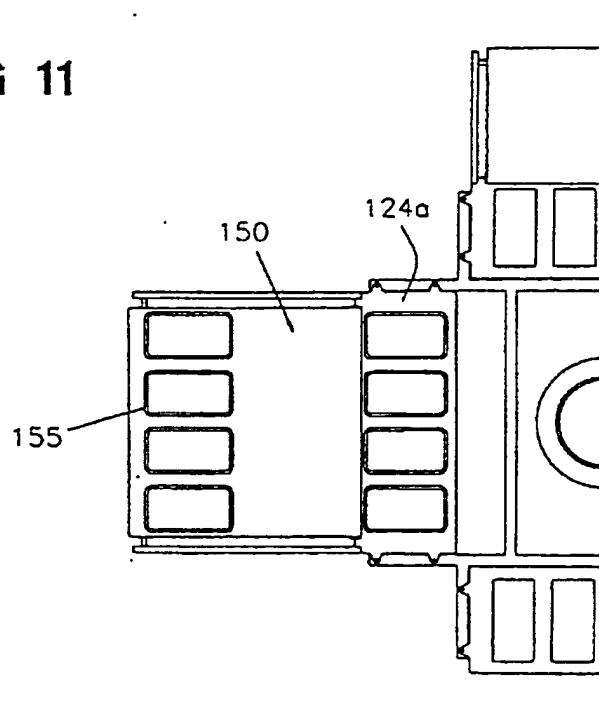


FIG 12

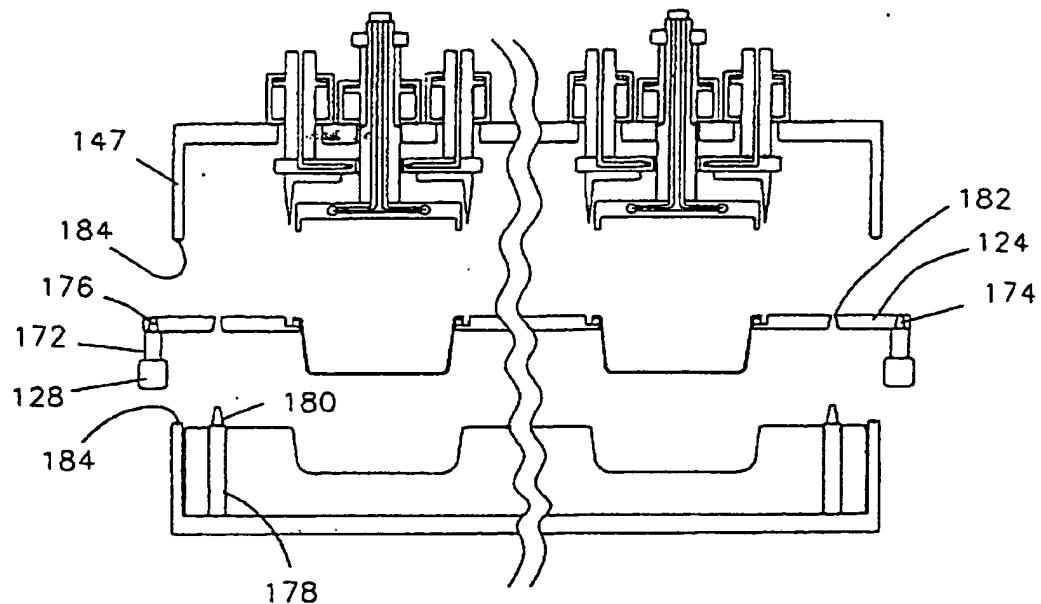


FIG 13

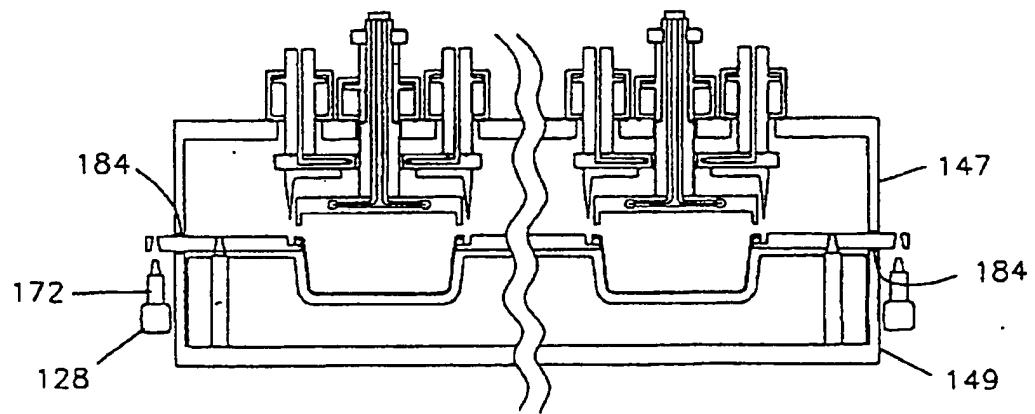


FIG 14

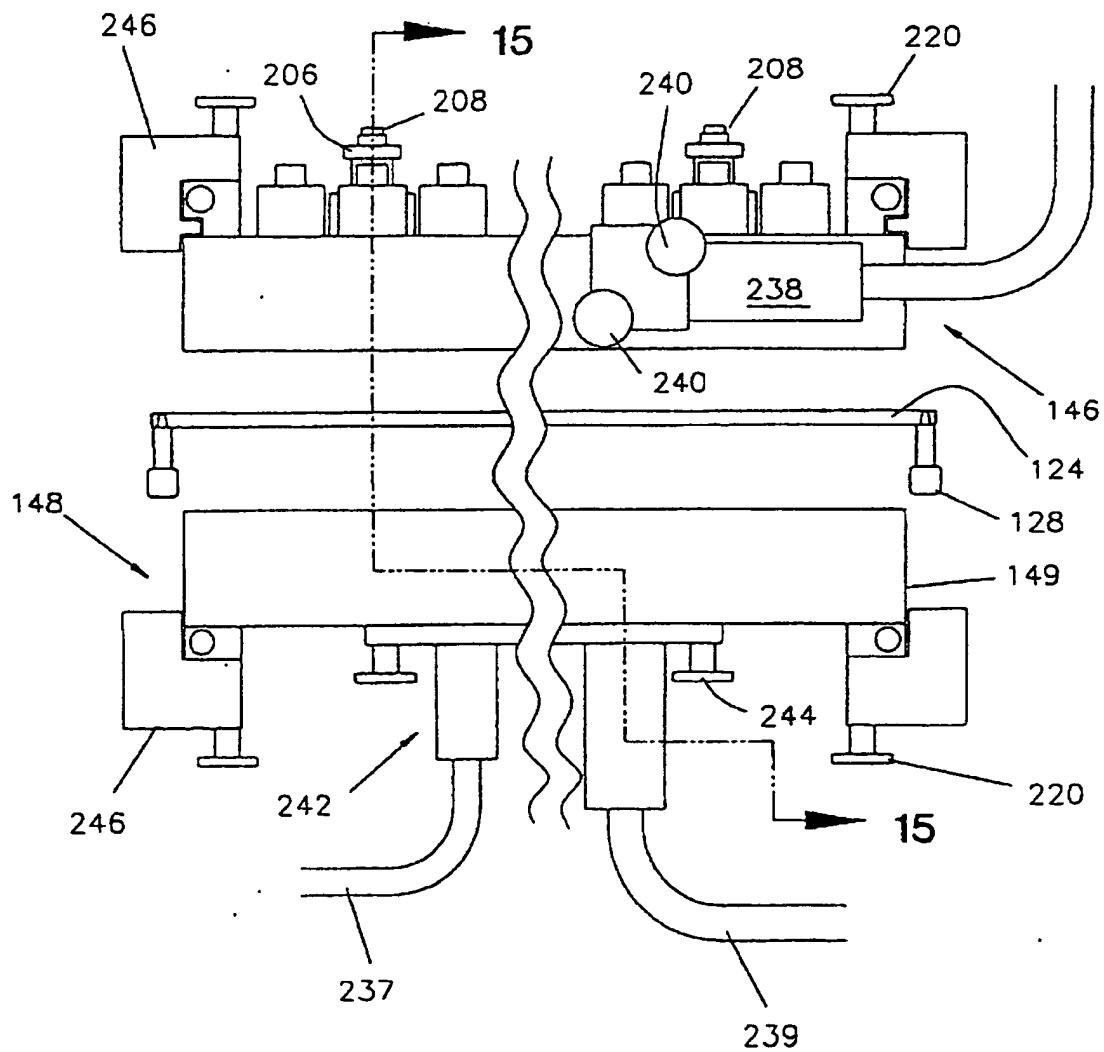


FIG 15

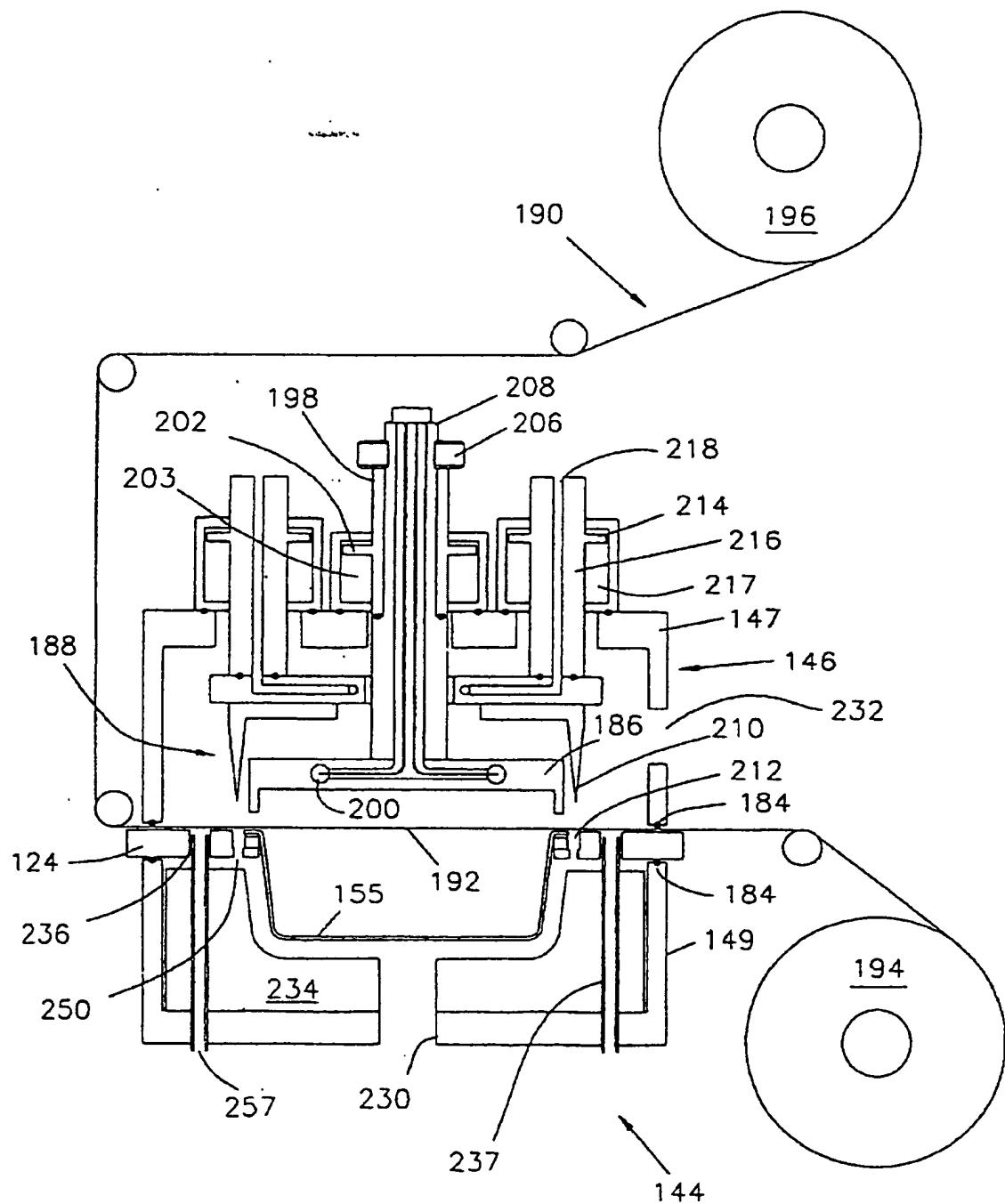


FIG 16

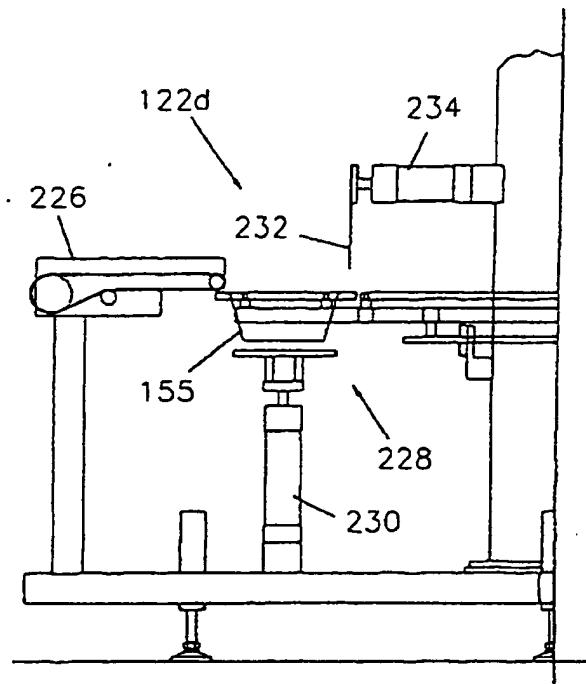


FIG 17

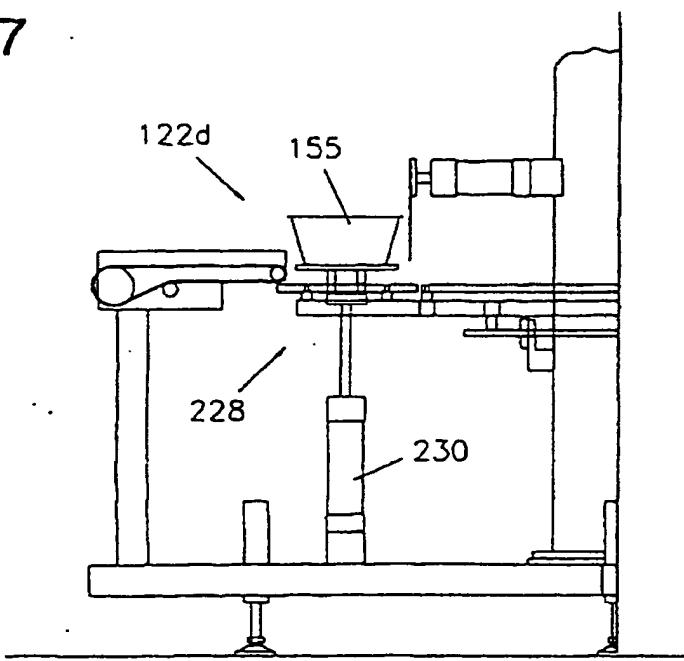


FIG 18

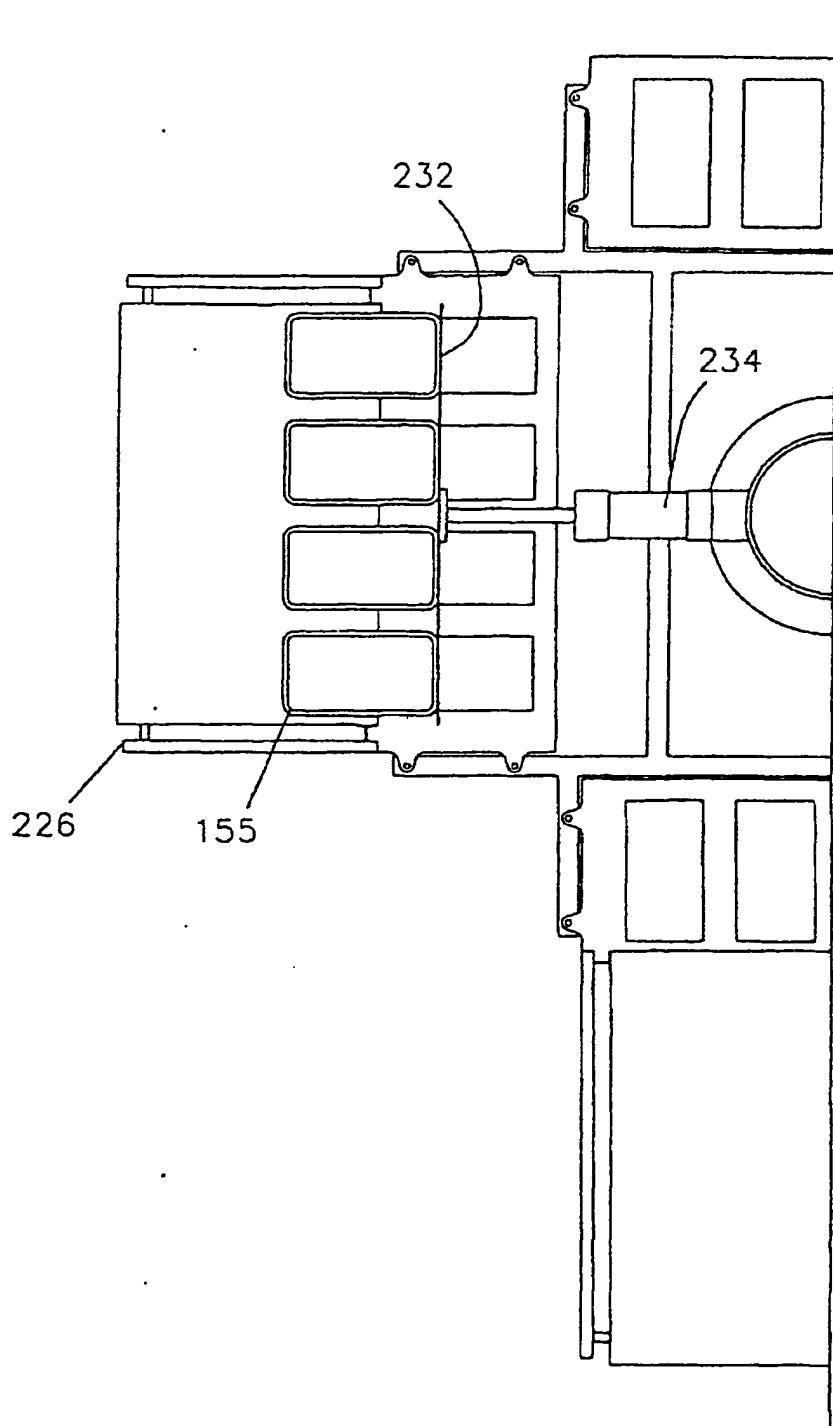


FIG 19

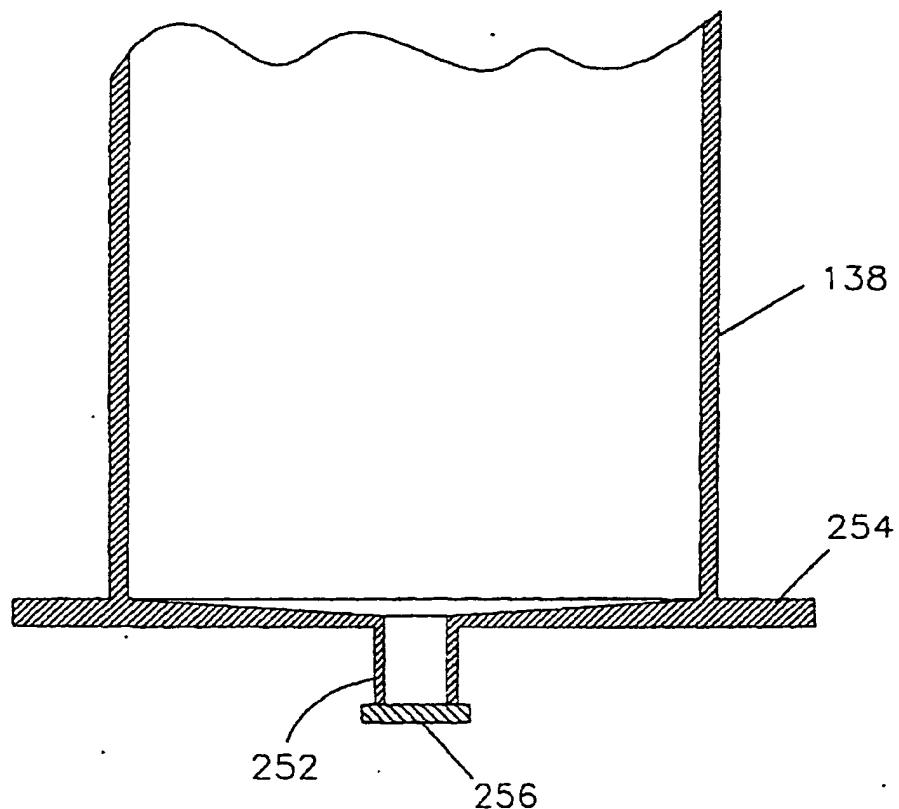


FIG 20

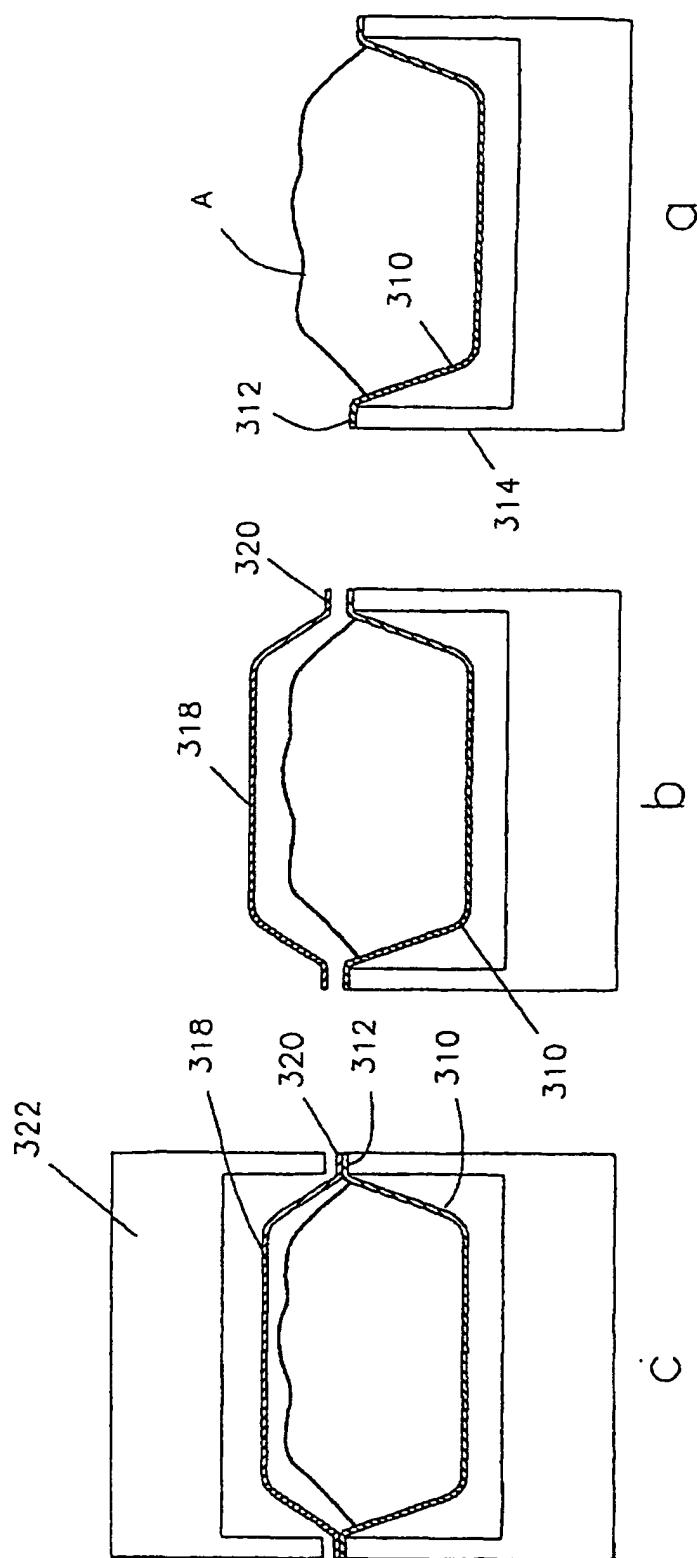


FIG 21

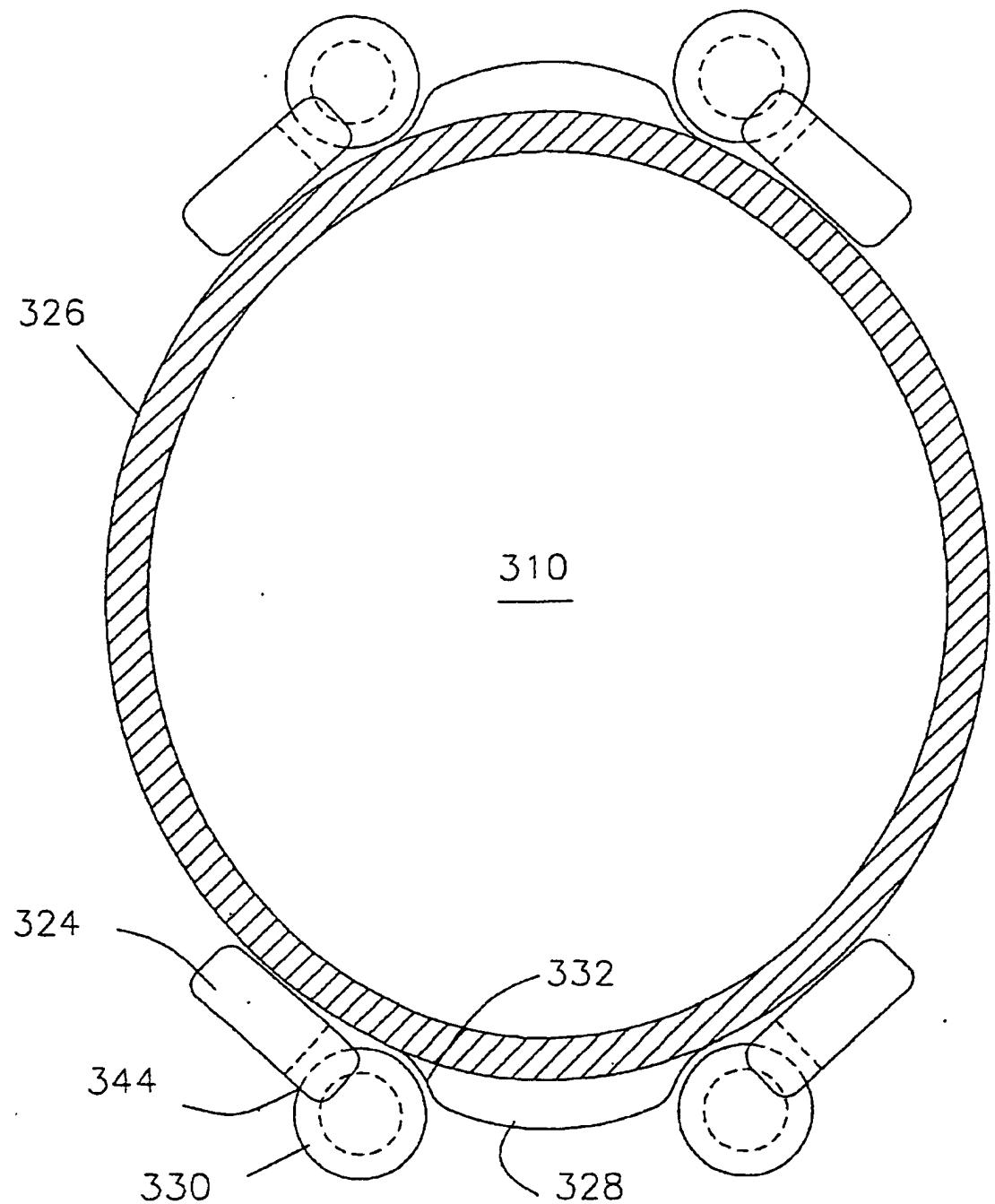


FIG 22

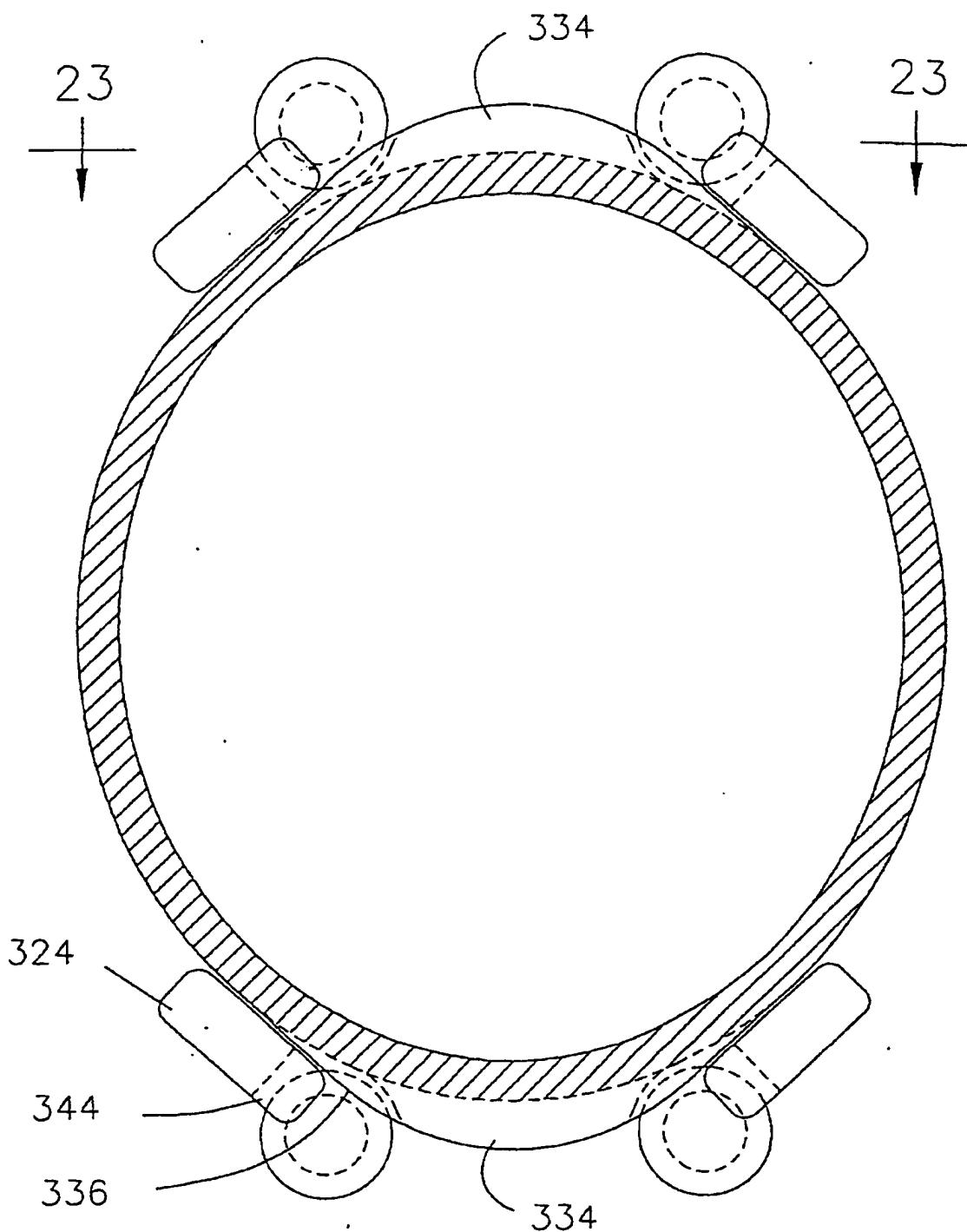


FIG 23

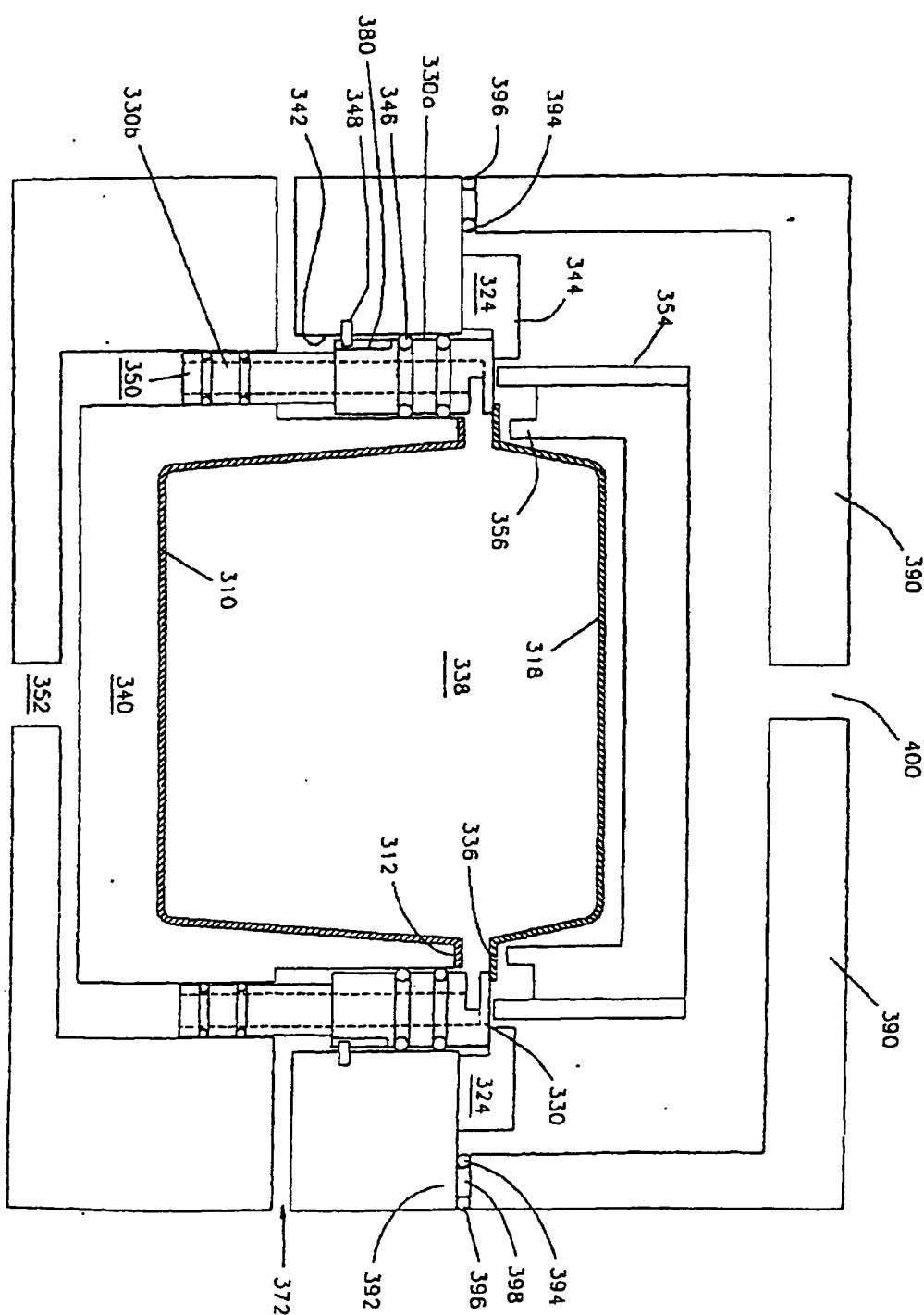


FIG 24

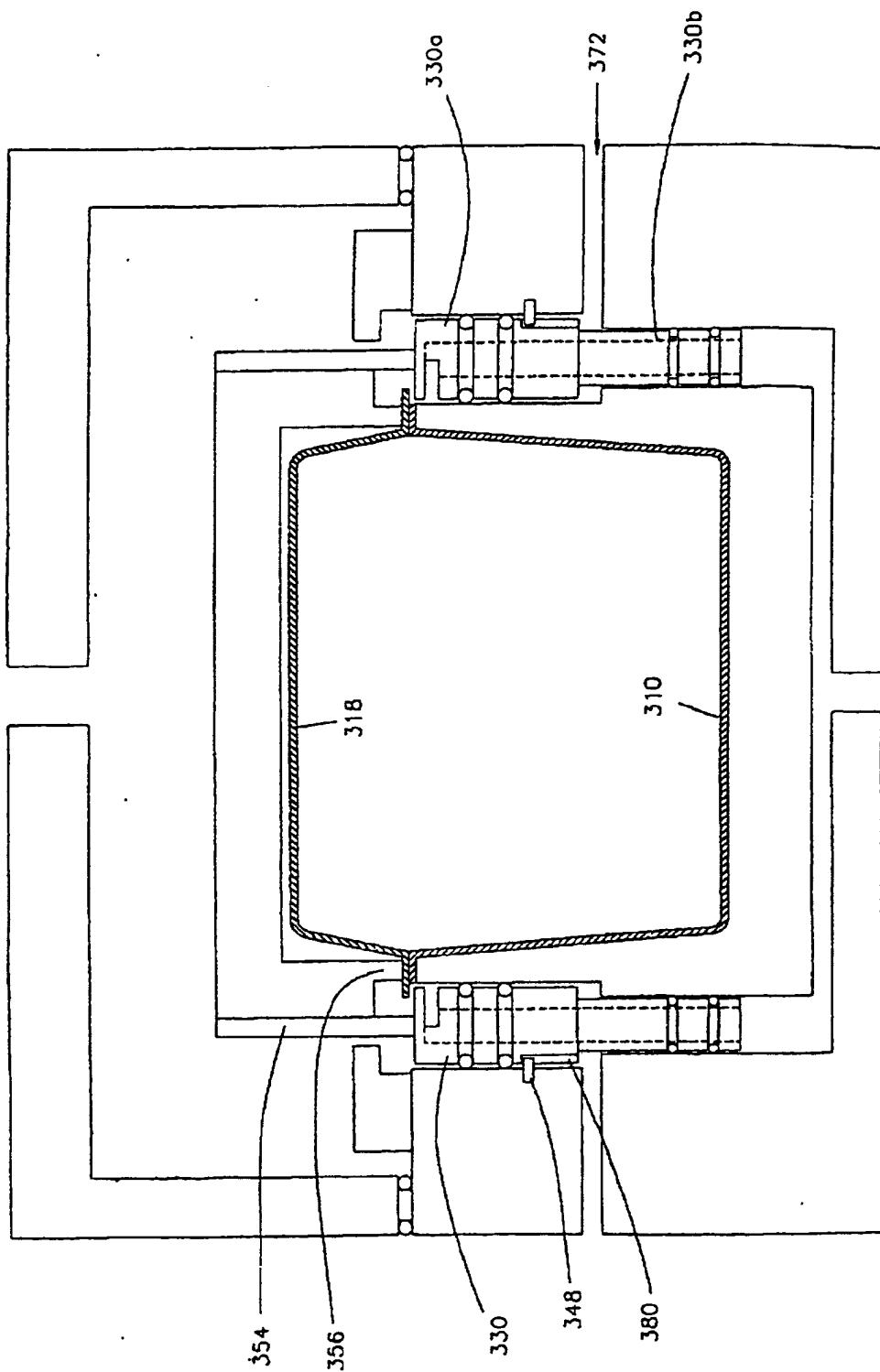


FIG 25

